

# **Test and Evaluation Cost Study**

## **DoD Cost Analysis Symposium**

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# Discussion Topics

- **Background**
- **Data Collection / Analysis**
- **Specific T&E Issues**
- **Conclusions**

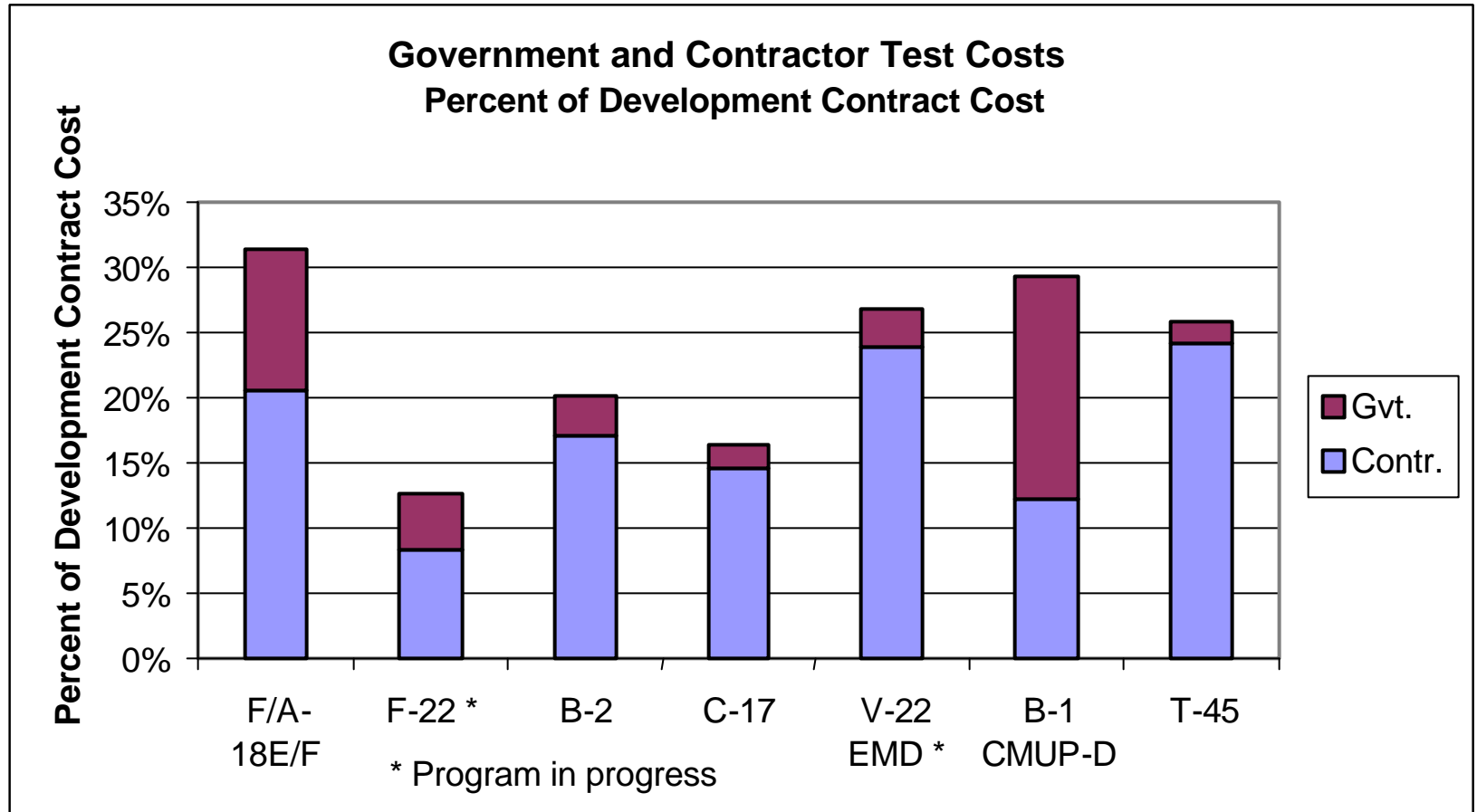
# Project Objectives

- **Analyze the Nature of Current Aircraft and Missile T&E Costs and Trends Likely to Affect Them in the Immediate Future**
  - **Focus on Cost to Program, not Theoretical Cost to DoD**
  - **Address System Level Testing (ST&E), not Component Level**
- **Identify Key Cost Drivers**
- **Collect, Normalize, and Document Representative Data**
- **Develop a Set of Practical Cost Estimating Methodologies Using Variables Normally Available to Cost Estimators**
  - **First of Several Planned Studies on Non-Air Vehicle Cost Elements**

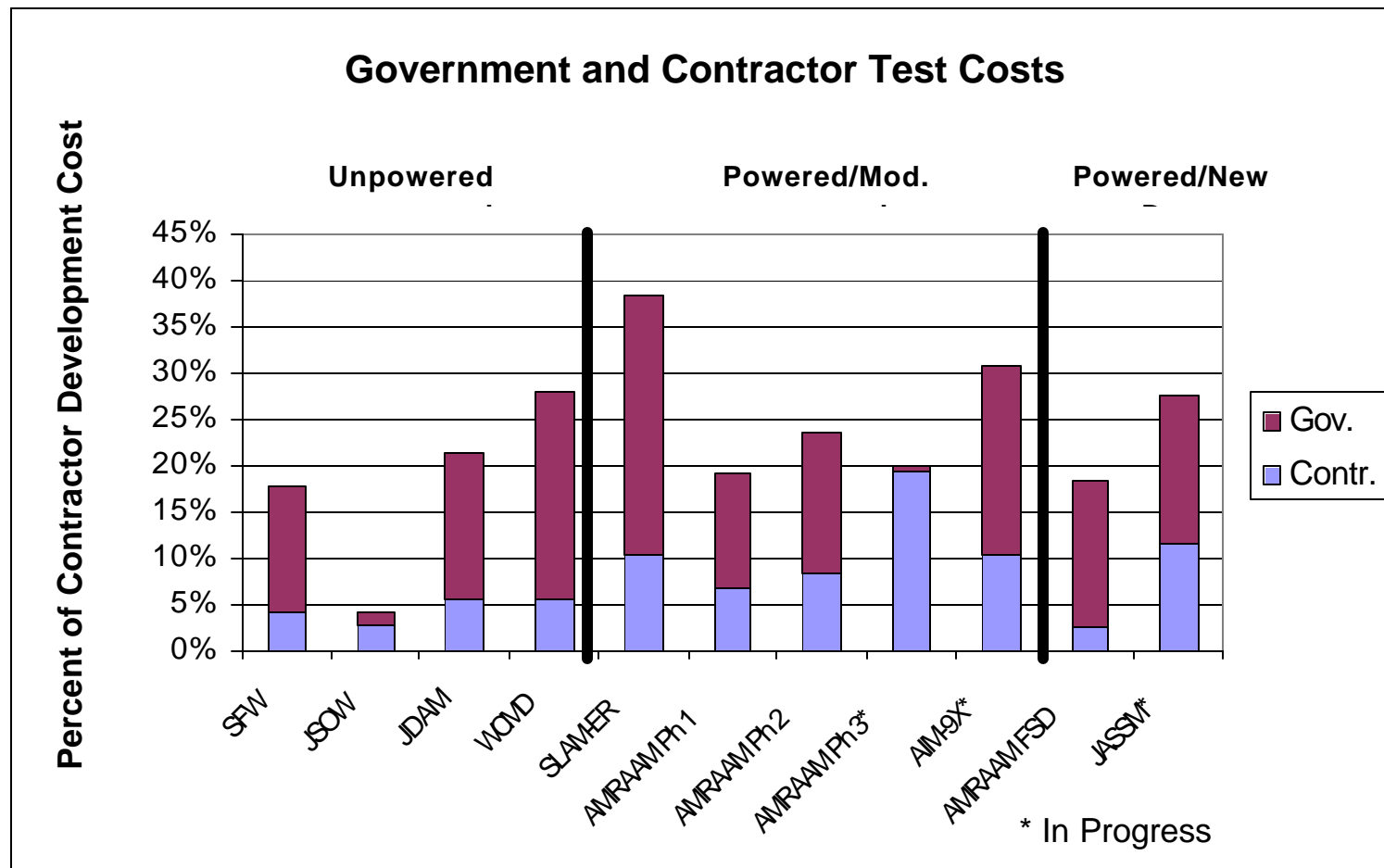
# T&E Background

- **Test and Evaluation Ensures System Will Perform As Intended In Its Operational Environment**
- **Three Distinct Constituencies**
  - Design Team
  - Management
  - Users
- **Schedule and Cost Pressures on All Aspects of Acquisition, Including T&E**
  - Claims of Savings Due To:
    - Modeling & Simulation
    - Integrated Systems Engineering Process
    - Acquisition Reform

# How Much is Enough? Aircraft



# How Much is Enough? Weapons



# Discussion Topics

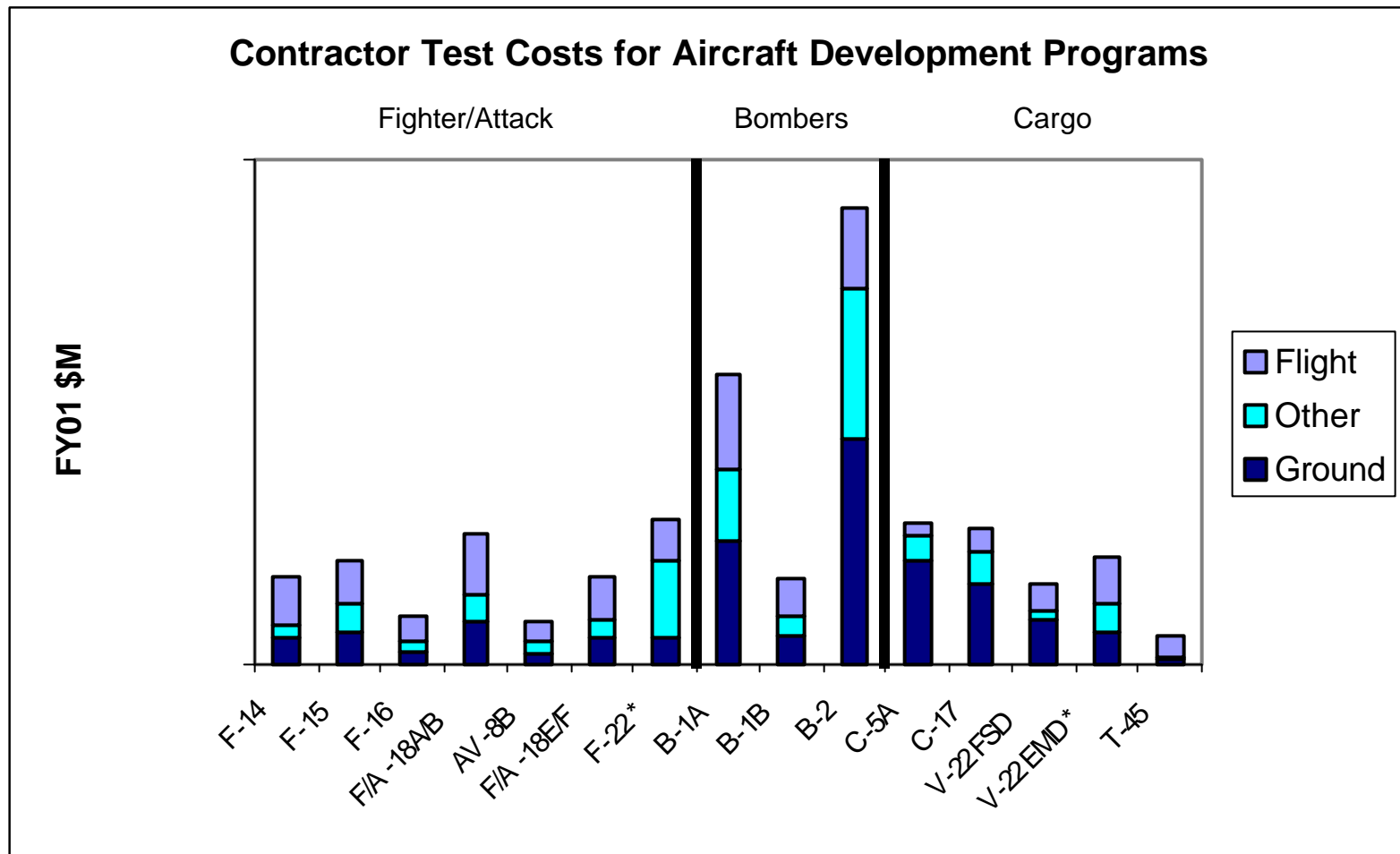
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# Organizations Visited

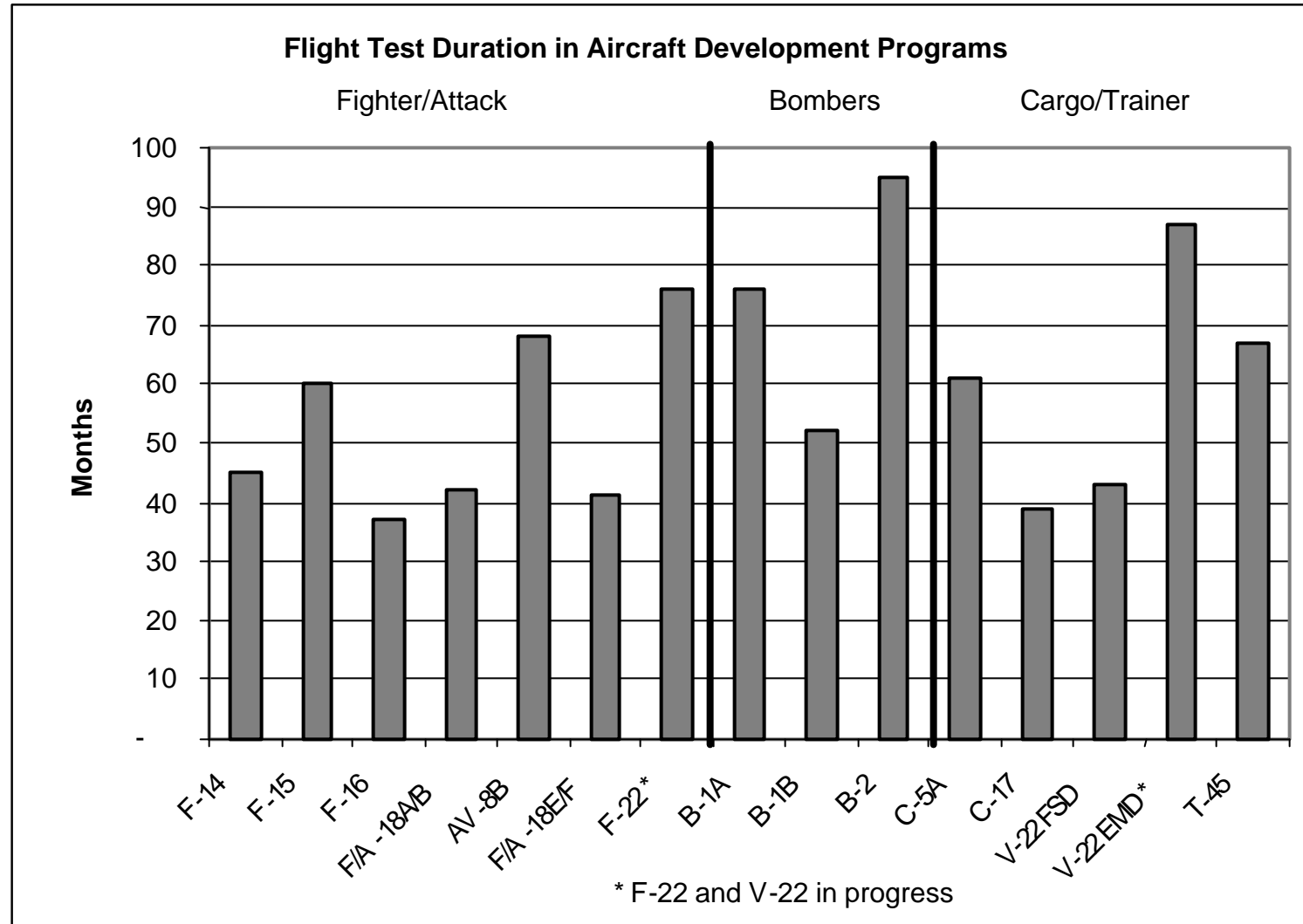
Washington	PAX	Eglin	Wright Patterson	Other
AFCAA	AIR 4.2/4.11	46TW	ASC/FMC	AFFTC
NCCA	AIM-9X	AAC/FMC	B-1B	NAWC-WD
OSD CAIG	SLAM-ER	JASSM	B-2	AFOTEC
AF/TE	T-45	AMRAAM	C-130J	OPTEVFOR
N091	Tomahawk	SFW/WCMD	C-17	Lock.-Martin (Ft. Worth)
JSF	V-22		F-16	Raytheon (Tucson)
DOT&E	JSOW		F-22	Boeing (St. Louis)
	F/A-18		JPATS	
	NAWC-AD			



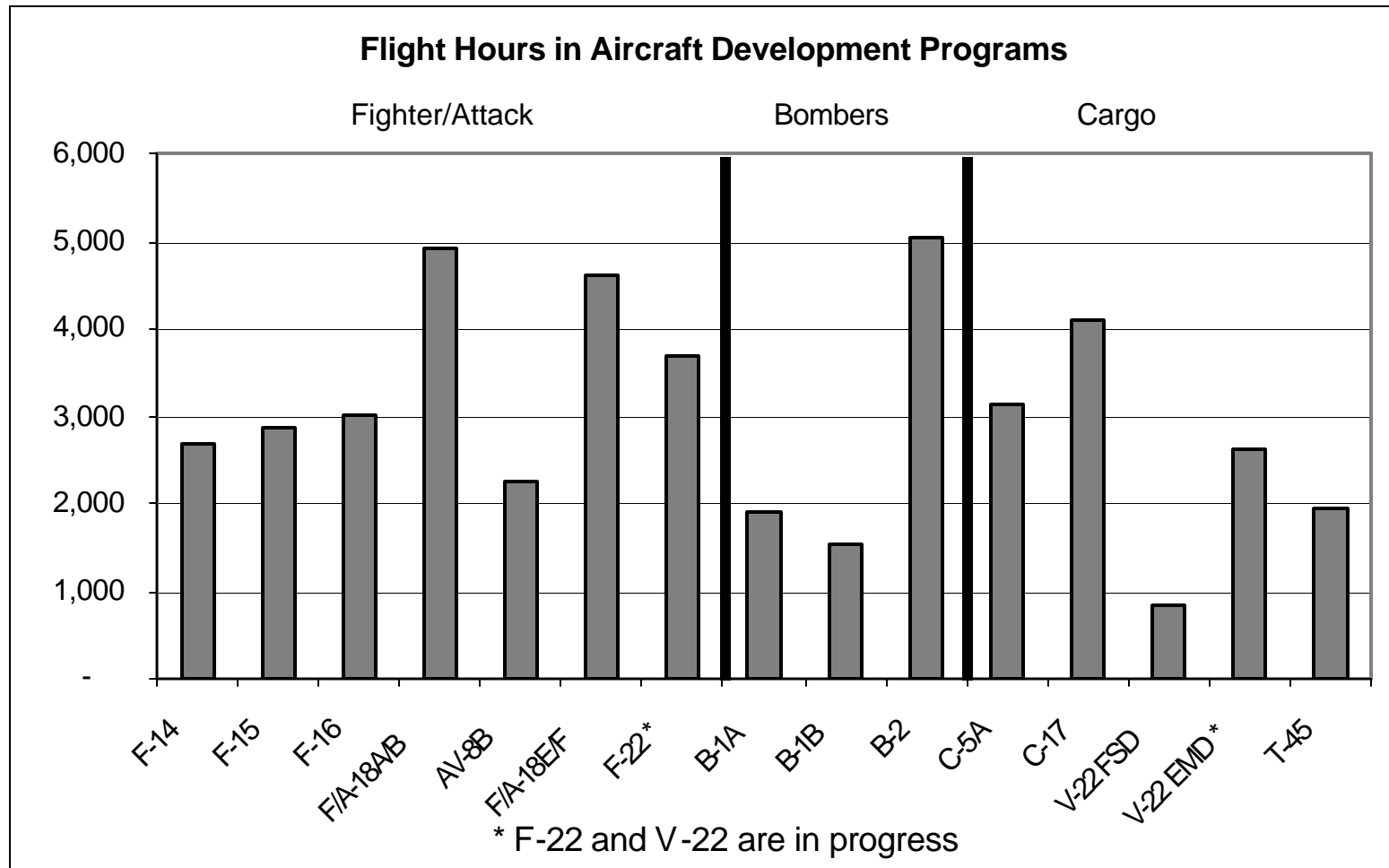
# Aircraft T&E Costs Have Not Declined Over Time



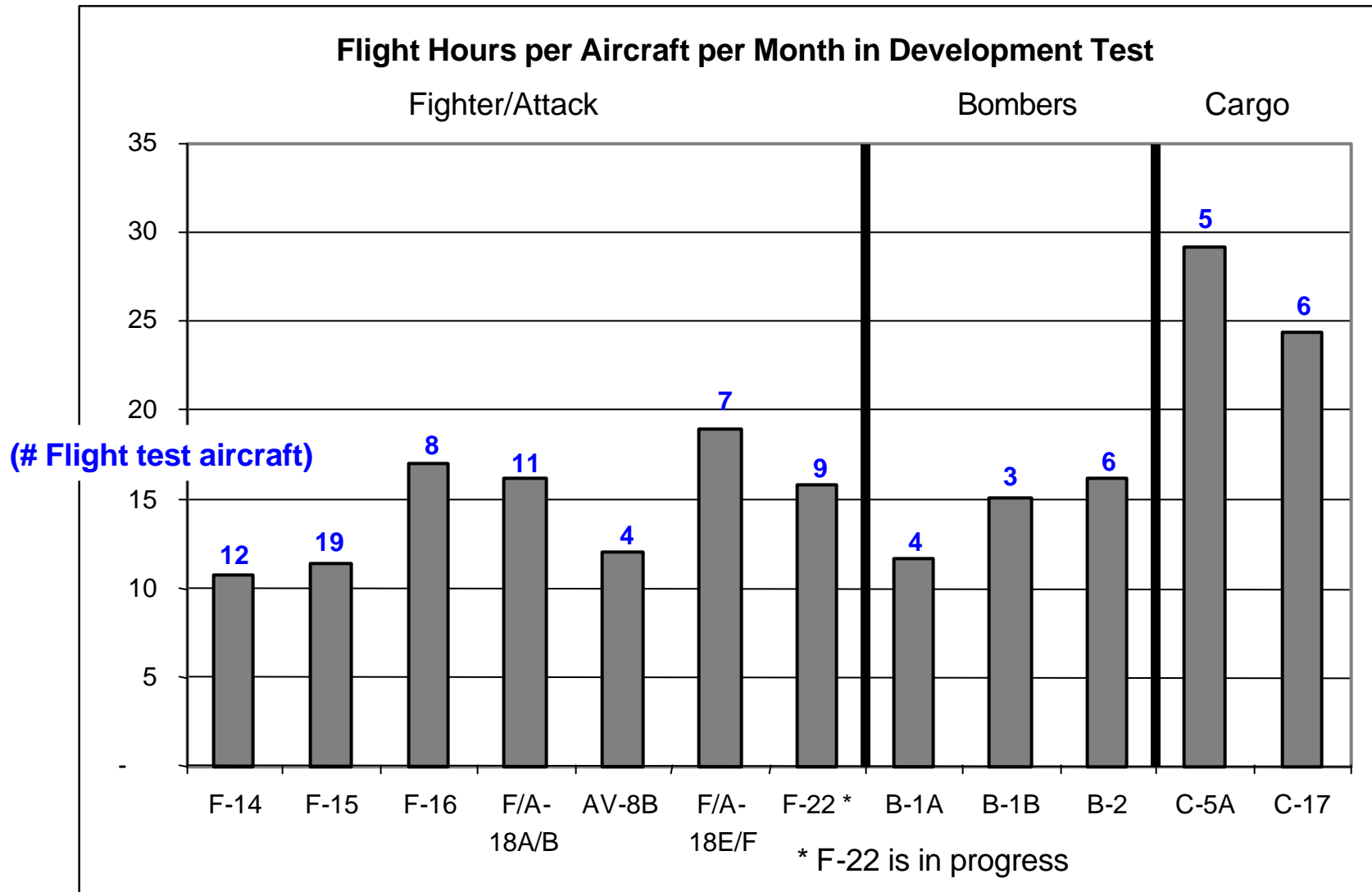
# No Apparent Reduction in Flight Test Duration



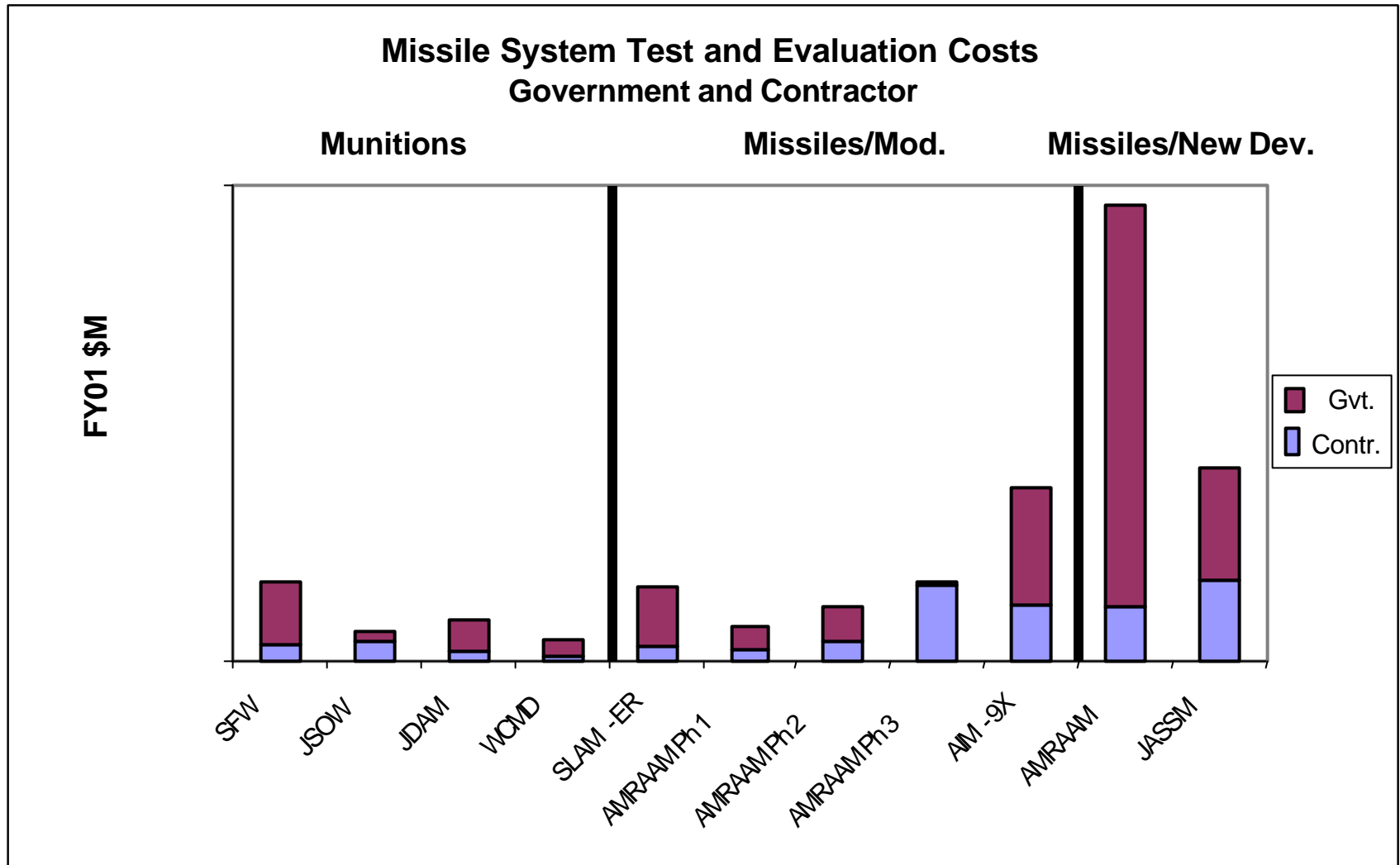
# No Apparent Reduction in Flight Hours



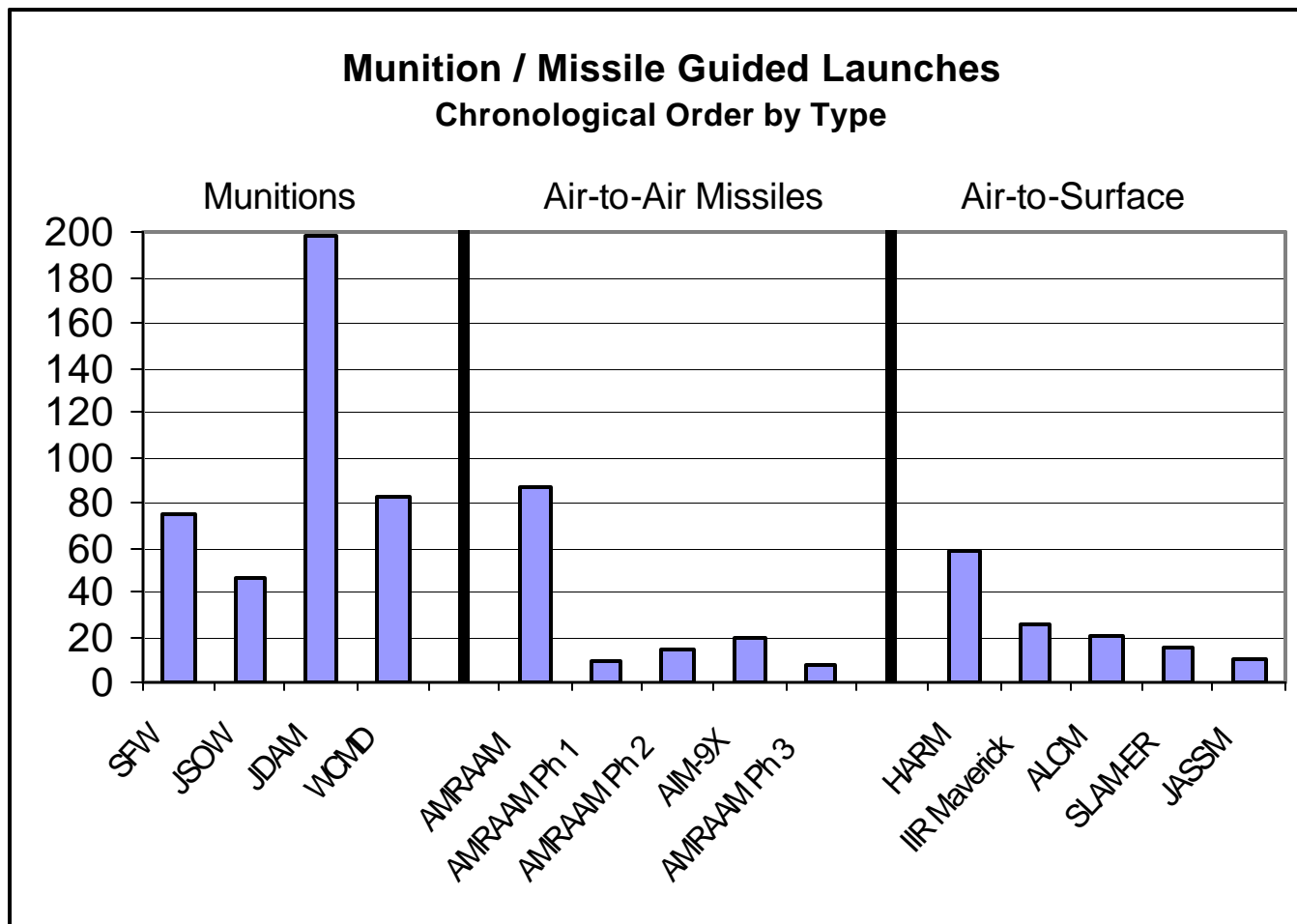
# Achieved Flight Hours per Aircraft per Month



# Weapon T&E Costs Vary by Type



# Trends in Guided Launches



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# Specific T&E Issues

## •Modeling & Simulation

- Integral Part of Most Modern T&E
- Reduces Live Testing for Comparable Data
- Improves Quality of Live Tests
- Cost Savings Difficult to Quantify
- Only Practical Approach in Some Situations
- Physics-Based Models Tend to Have Higher Fidelity
  - Some Limitations with Complex Interactions
    - Wing Drop
    - Stores Buffeting
    - Target Damage
- Many Models Are Program-Specific
- Requires Significant Early Investment



# Specific T&E Issues (Cont'd)

## •Software Intensive Systems

- Major Challenge
  - Often Impacts Other Parts of Test Program
  - Often on Critical Path
- Requires Appropriate Test Infrastructure
- Expertise in Short Supply

## •Gov't vs. Contractor Test Facilities

- Contractors Generally Prefer Their Facilities If Available
  - Government Provides Low Use/High Cost Facilities
- TSPR Contractors Subcontracting to Gov't For Specialized Services
- Gov't Facilities Usage Planning Difficult
  - Up to 50% “Walk-in” Business
  - Marketing Their Capabilities

# Specific T&E Issues (Cont'd)

## •NDI/COTS

- Must Still Test in Operational Environment
- FAA Certification Does Not Address All Military Requirements
- Performance Specs Must Be Carefully Drawn

## •Live Fire Testing

- Integrated Into Developmental. Testing Program
- Balance of Risk vs. Cost

## •Combined DT/OT Appears to be Successful

- “Early Involvement” of Operational Testers Considered Beneficial by All Parties
- Constrained by Limited OT Staffing

# Specific T&E Issues (Cont'd)

## •Innovative Approaches – Mixed Results

- Testing to Total System Performance Specifications
  - Contractor Designed/Directed Test Program
  - Reduced Government Leverage Over Changes Affecting External Systems/Activities
  - Early OT Involvement Important to Identify Issues Early
- FAA Certification Not Intended to Meet Military Requirements
- Most T&E Is Tailored to Program
  - Common-Sense Approach
  - Could Lead to “Test-to-Budget”

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# Conclusions

- **T&E Has Been a Relatively Consistent Proportion of Development Cost For Past 25-30 Years**
  - **Test Execution More Efficient**
    - **Cost of Individual Test Functions May Have Decreased**
  - **Current Test Programs Have More Content/Complexity**
    - **Mission Systems/Avionics**
    - **Software Intensive Systems**
    - **Signature Reduction**
    - **Interfaces with External Systems**
    - **Multi-Mode/ECCM Features**
    - **More Rigorous Standards**

# Conclusions (Cont'd)

- **Perceived Pressure to Reduce Testing Time and Cost**
  - Test Program Slips Often Due to Late Receipt of Test Articles or Deficiency Correction
  - Test Programs Are/Should Be Adjusted Based on Test Results
- **M&S Now Essential for Resource-Intensive Testing**
  - Impact on Open Air Testing
    - Simulate-Fly-Compare
    - Reduced # Flights for Equivalent Test Data
    - Increased Productivity of Remaining Live Tests
  - Models Later Support P<sup>3</sup>I and Training Activities

# Conclusions (Cont'd)

- **Data on Government Test Costs Not Readily Available**
  - Still Substantial Part of Total T&E Costs
  - Apparently Little Systematic Analysis or Retention
    - Eglin Earned Value Management System is Exception